CLAIMS

What is claimed is:

1. A method comprising:

determining the average thickness of a film deposited over a substrate;

measuring at least one of the resistance and conductance of the film at a plurality of locations;

determining the sheet resistance at each of the plurality of locations;

calculating the average sheet resistance for the plurality of locations;

calculating the average resistivity using the average thickness of the film and the average sheet resistance; and

determining the thickness of at least one location of the plurality of locations using the average resistivity and the determined sheet resistance of the film at the location.

2. The method of Claim 1, wherein determining the average thickness of a film deposited over a substrate comprises:

depositing the film on the substrate;

determining the mass of the film material deposited on the substrate;

determining the film density of the film;

determining the surface area over which the film is deposited; and

calculating the average thickness using the mass of the film material, the film density, and the surface area.

3. The method of Claim 2, wherein determining the mass of the film material deposited on the substrate comprises:

taking a coulometer measurement during the deposition of the film on the substrate; and

using the coulometer measurement to determine the mass of the film material.

4. The method of Claim 1, wherein measuring at least one of the resistance and conductance of the film at a plurality of locations comprises:

inducing an eddy current in the film deposited over the substrate at a first location;

monitoring an electrical response modified by the induced eddy current to determine at least one of the resistance and conductance of the film at the first location; and

repeating the acts of producing an eddy current and monitoring the electrical response for each of the plurality of locations.

5. The method of Claim 1, further comprising placing the substrate in contact with a thermal heat sink to control the temperature of the substrate.

6. The method of Claim 1, wherein measuring at least one of the resistance and conductance of the film at a plurality of locations is controlled for temperature stability, controlling for temperature stability comprises:

processing the substrate; and

waiting a predetermined time for the substrate temperature to approach the ambient temperature before beginning to measure at least one of the resistance and conductance of the film.

7. The method of Claim 1, wherein measuring at least one of the resistance and conductance of the film at a plurality of locations is controlled for temperature stability, controlling for temperature stability comprises:

repeatedly measuring at least one of the resistance and conductance of the film at a first location until the difference between the last two measurements are below a threshold; and

measuring at least one of the resistance and conductance of the film at the remaining locations.

8. The method of Claim 1, wherein measuring at least one of the resistance and conductance of the film at a plurality of locations is controlled for temperature stability, controlling for temperature stability comprises:

measuring the temperature of the substrate when measuring at least one of the resistance and conductance of the film at each location; and

adjusting the measured resistance or conductance from each of the plurality of locations to be referenced to the same temperature.

9. The method of Claim 4, wherein producing an eddy current in the film is performed at multiple excitation frequencies.

10. The method of Claim 1, wherein measuring at least one of the resistance and conductance of the film at a plurality of locations comprises measuring at least one of the total resistance and total conductance of the film and the substrate at a plurality of locations, the method further comprising:

measuring at least one of the resistance and conductance of the substrate at the plurality of locations prior to depositing the film on the substrate;

determining the resistance or conductance of the film using the measured at least one of the resistance and conductance of the substrate and the measured at least one of the total resistance and total conductance of the film and film.

11. A system for determining the thickness of a conductive film on a substrate, the system comprising:

a first sensor for measuring the mass of the conductive film deposited on the substrate, the first sensor providing signals indicative of the mass of the conductive film; a second sensor for measuring at least one of the resistance and conductance of the conductive film on the substrate at a plurality of locations, the second sensor providing signals indicative of at least one of the resistance and conductance of the conductive film;

a computer system coupled to the first sensor to receive the signals indicative of the mass of the conductive film, the computer system coupled to the second sensor to receive the signals indicative of at least one of the resistance and conductance of the conductive film, the computer system having a computer-usable medium having computer-readable program code embodied therein for:

calculating the average thickness of the conductive film deposited over the substrate using the first sensor signals indicative of the mass of the conductive film;

calculating the sheet resistance of the conductive film at a plurality of locations using the second sensor signals indicative of at least one of the resistance and conductance of the conductive film for the plurality of locations;

calculating the average sheet resistance for the plurality of locations;

calculating the average resistivity using the calculated average thickness and the calculated average sheet resistance; and

calculating the thickness of at least one location of the plurality of locations using the average resistivity and the calculated sheet resistance at the location.

12. The system of Claim 11, wherein the first sensor is a coulometer coupled to an electrochemical cell that deposits a conductive film on a substrate, wherein the signals indicative of the mass of the conductive film are signals indicative of the amount of charge that passes through the electrochemical cell while depositing the conductive film on the sample.

13. The system of Claim 11, wherein the second senor is an eddy current sensor coupled to a stage, at least one of the eddy current sensor and the stage moves relative to the other.

14. The system of Claim 12, wherein the computer-readable program code for calculating the average thickness of a conductive film comprises computer-readable program code for:

calculating the mass of the film material deposited on the substrate using the amount of charge that passes through the electrochemical cell during deposition of the conductive film on the substrate; and

calculating the average thickness using at least the calculated mass of the film material, a predetermined film density value, and a predetermined surface area value.

15. The system of Claim 11, the computer-readable program code is for delaying the eddy current sensor measurements of the conductive film for a predetermined time after the substrate is processed.

16. The system of Claim 11, the computer-readable program code is for:

causing the eddy current sensor to repeatedly measure at least one of the resistance and conductance of the conductive film at a first location until the difference between the last two measurements are below a threshold; and

causing the eddy current sensor to measure at least one of the resistance and conductance of the conductive film at the remaining locations.

17. The system of Claim 11, the system further comprising a temperature sensor measuring the temperature of the substrate at approximately the same time that the eddy current sensor measures at least one of the resistance and conductance of the conductive film on the substrate at each of a plurality of locations, the temperature sensor producing a signal indicative of the temperature of the substrate, the computer system is coupled to the temperature sensor to receive the signals indicative of the temperature of the substrate, the computer-readable program code is further for:

adjusting the measured resistance or conductance from each of the plurality of locations based on the temperature of the substrate at approximately the same time that the eddy current sensor measured the resistance or conductance.

18. The system of Claim 11, wherein the eddy current sensor is a multiple excitation frequency eddy current sensor.

19. The system of Claim 11, wherein the eddy current sensor measures the at least one of the resistance and conductance of the substrate at the plurality of locations before the conductive film is deposited on the substrate, the computer-readable program code is further for:

determining the resistance or conductance of the film using the measured at least one of the resistance and conductance of the substrate and the measured at least one of the resistance and conductance of the film